DOCUMENT RESUME

ED 409 759 HE 030 233

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TITLE Actor Networks and the Division of Knowledge in the University.
PUB DATE Mar 97
NOTE 9p.; Paper presented at the Annual Meeting of the American Educational Research Association (Chicago, IL, March 24-28, 1997).
PUB TYPE Opinion Papers (120) -- Speeches/Meeting Papers (150)
EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Educational History; Epistemology; Higher Education; Humanities; *Intellectual Disciplines; *Interdisciplinary Approach; Natural Sciences; Social Sciences; *Universities

ABSTRACT

This paper discusses the current division of knowledge at the college and university level, its historical roots, and the application of Actor Network Theory (ANT) to arrive at an explanation of the permanence of the current division of knowledge as well as what form a new division of knowledge might take. It finds fragmentation and disintegration characteristics of contemporary American higher education, divisions within the natural and social sciences, and a high level of irrelevance. The ANT perspective argues that today's division of knowledge reflects the historical development of diverse and often conflicting networks of people and things associated with various departments and disciplines. These networks consist not only of disciplinarians, professional associations, and diverse client groups, but also include a wide range of physical objects such as laboratories, specialized instruments, money, and libraries. It shows how in fields such as agronomy new divisions have emerged in recent years and argues that the only way to dissolve the barriers between disciplines is to build counter networks between and among disciplines. (Contains 20 references.) (MDM)

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ED 409 759

# Actor Networks and the Division of Knowledge in the University

Paper presented at the annual meetings of the American Educational Research Association, Chicago, March, 1997

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# Actor Networks and the Division of Knowledge in the University

Lawrence Busch

The current division of knowledge in the university is neither the result of careful planning nor of some grand epistemological scheme. It has its roots in seventeenth century disputes over the roles of the Church and State as well as in the practical problems faced at that time. For example, early physics was closely tied to practical concerns for better methods of navigation, more efficient waterwheels, and improvements in mining (Cardwell 1971).

Yet, just as the medieval Trivium (grammar, logic, and rhetoric), and Quadrivium (arithmetic, geometry, astronomy, and music) outlived their usefulness as a division of knowledge, there is some evidence that the current division of knowledge may also be in need of replacement. Consider the current situation with its many divisions:

- Affective knowledge is separated from rational knowledge. The rational is generally considered more reliable than the affective. I should also note in passing that the affective is often considered feminine and the rational masculine, a position that dates at least as far back as Sir Francis Bacon (Keller 1985). Moreover, there is a strong tendency to separate the affective from the rational so as not to sully it with emotion. Feminist critics have been quick to point out the fallacious character of this separation.

- Knowledge of the natural world is separated from knowledge of the social world in what Snow (1959) called the "two cultures." Knowledge of the natural world is generally considered more reliable than knowledge of the social world. This is especially claimed to be the case in as much as knowledge of the natural world is seen as easily quantifiable and predictable, while knowledge of the social world tends to resist quantification. Camps on both sides of this divide are quick to point out the essential irrelevance of the other side for what they are doing. Dilthey and other German historicists even went so far as to argue that the methods of research of the *Geisteswissenschaften* and *Naturwissenschaften* were fundamentally different (Dilthey 1961). Thus, ecologists struggle to study nature in its pristine form, defined as lacking in human intervention, while social scientists--including educators--steadfastly ignore how the physical world is (re)structured so as to consolidate or erode certain networks.

- Within the natural sciences, so-called basic research fields are clearly demarcated from applied, technological fields of engineering. Researchers in the basic research fields claim to be producing knowledge for knowledge's sake. They claim that they are engaged in pushing back what Vannevar Bush (1945) called *The Endless Frontier*. In contrast, engineers are quite eager to point out the direct relevance of their work for practical application.

- The humanities are neatly bounded from the social sciences. Much social science research

is utterly ahistorical. Little is much concerned with ethics or philosophy or art. But humanists are equally set apart by their apparent lack of interest in the issues that are central to the social sciences.

- Within the social sciences, the practitioners of the basic social sciences do their best to emulate the physical sciences assuring that their work has little import outside the university. In contrast, the applied social sciences, including education, often eschew theoretical work, leading them to be wholly ahistorical in character. Moreover, the very disciplinary character of the basic social sciences often makes their content irrelevant to the applied social sciences.

- Moreover, the major social sciences--sociology, economics, political science, psychology--tend to ignore each other with great fastidiousness. Reading a typical introductory sociology text one would think that politics and economics were non-existent or mere epiphenomena. In contrast, in economics texts perfectly autonomous individuals make perfectly rational economic choices without regard to class, race, ethnicity or gender.

- Anthropology conveniently divides the world with sociology into the small, simple societies of the third world and the sophisticated, complex and urban societies of the West. Even their methods--ethnography for anthropology, surveys for sociology--suggest the divide between them. We claim to be in possession of direct knowledge of the world, while those in other (non-Western) cultures see the world only through a glass darkly (Latour 1993b). Moreover, social and economic development is defined largely as catching up with the material abundance of the West.

While the above description may be a bit exaggerated, I believe that it does capture the fragmentation and *dis*integration that characterizes contemporary American higher education. It also accounts for its high level of irrelevance in spite of the myriad issues facing society. As Umberto Eco put it: "Nothing more closely resembles a monastery (lost in the countryside, walled, flanked by alien, barbarian hordes, inhabited by monks who have nothing to do with the world and devote themselves to their private researches) than an American university campus"(Eco 1983, 83).

But does it make sense to separate the affective from the rational if we care about the world? Does it make sense to divide the social from the natural if all fields of knowledge must interpret the world (Rouse 1987)? Does it make sense to divide the social sciences from the humanities? Does it make sense to have a separate field for the study of "us" and another for the study of "them"? Does it make sense to separate the natural and social sciences if the findings of *all* fields of knowledge transform society? If knowledge, power and ethics are inextricable? How can we explain why this rather confused and outmoded division of intellectual labor continues to persist? How can we overcome it?

Since the 1970s, studies of higher education have typically employed cultural models (e.g., Biglan

1973a, 1973b; (Bernstein 1974). Yet, while it is empirically obvious that disciplinary divisions exist (See, e.g., Austin [1990] for a review of some of the classificatory systems), cultural explanations of the divisions that I described above are really not explanations at all. They merely beg the question by positing something called culture that somehow creates barriers to the relations between and among the disciplines. Culture itself remains unexplained, black-boxed. Organizational explanations (at least of the conventional sort) are equally inadequate because they imply that organizational structure is infinitely flexible and only maintains a certain form as a result of tradition. In contrast, Actor Network Theory (ANT) suggests both an explanation of the permanence of the current division of knowledge as well as what form a new division of knowledge might take (Boltanski and Thévenot 1991; Latour 1993b).

In brief, from an Actor Network perspective, today's division of knowledge reflects the historical development of diverse and often conflicting networks *of people and things* associated with various departments and disciplines (Callon 1991; Latour 1987). Such networks have been built over the centuries to reflect specific problems, strategies, and solutions. These networks consist not only of disciplinarians, professional associations and diverse client groups, but also include a wide range of physical objects such as laboratories, research farms, specialized instruments, money, libraries, offices, and specialized classrooms.

For example, engineering and agricultural faculties often have strong external client groups that influence the content and substance of their research and teaching programs through funding, provision of equipment, and access to off-campus facilities at which experimental results can be scaled up. Medical faculties are linked to hospitals, medical hardware, insurance companies, and a continuous flow of patients for training and research. Faculties at colleges of education are embroiled in the debates over the future of public education by virtue of their responsibility for training future teachers. To be successful, they require access to public schools, experimental classrooms, new teaching technologies and a continuous flow of elementary and secondary teachers seeking in-service training. Physical science faculties are linked to government science agencies and the funding that provides large, highly specialized equipment to them such as cyclotrons, optical and radio telescopes, and supercomputers. Social science faculties require access to computers with statistical and qualitative analysis programs, large scale packaged data sets such as those prepared by the Census Bureau. Applied social sciences are often oriented toward, and owe their existence to, particular policy decisions. And, arts and humanities faculties, although they are increasingly marginalized, are closely linked to libraries, arts patrons, galleries and theaters.

Members of each of these fields seek to *enroll* new members by creating *black boxes* through which others must pass. These black boxes may be facts, machines, natural objects or organizations. As little as 15 years ago, most of us got along just fine without desktop computers whereas today they are not merely a convenience, but a necessity for any university that wishes to do serious research. But more specialized black boxes succeed equally well in enrolling others. For example, much contemporary biology is impossible without the "central dogma" of DNA, electrophoretic equipment, gas chromatographs, gene guns, and other exotic instruments.

Biologists include not only these instruments in their networks; they also include the companies that manufacture and repair instruments as well--companies that are themselves black boxes for the scientists.

Similarly, studies of higher education have their own black boxes, the obligatory passage points through which practitioners must pass. The most obvious candidate is the culture perspective itself. All the differences and all the similarities of the disciplines and of universities as a whole are viewed through the lens of culture. Culture explains nearly everything, but culture itself is largely unexamined. Since the focus is on beliefs--which cannot be directly known by others--the only evidence for their existence must come from reports of beliefs, which are notoriously dependent on question wording and often are connected only weakly to actual behavior. As with all black boxes, opening the black box of culture is difficult, requiring many counterexamples, debates, challenges to established orthodoxy and status hierarchies! And, it may not be successful.

Consider also a biological science as an example: agronomy. Until several years ago agronomy was a highly unitary discipline. Virtually all agronomists focused on increasing the productivity of field crops by engaging in varietal testing and improvement of whole plants using analysis of variance to test differences in plot yields under varying fertilization, soil type and climatic conditions. Agronomists were distinguishable from other agricultural scientists by the crops they worked with, their research goals, their clientele, etc. (Busch and Lacy 1983). Cultural theorists might argue that they shared the same culture. But ANT proponents would note that they were linked in a complex network of people (e.g., commodity producers and processors) and things (e.g., statistical techniques, computer programs, soil testing equipment, yield measurement techniques, etc.).

Today, a look at the same field reveals three somewhat overlapping yet distinct agronomies: First, there is the older agronomy as described above. But in addition, molecular biologists now examine the basic molecular structure of plant cells. Their clients are not farmers who grow the crops but chemical and pharmaceutical companies that own the large seed companies and that compete for intellectual property rights on the new products of the public labs (Busch et al. 1991). Their labs in no way resemble the labs of conventional agronomists. Many have even abandoned the goal of increased yield, focusing instead on developing crops with specific properties of interest to processors and chemical companies. Finally, there are the alternative agriculture agronomists who disparagingly look at old-style agronomy as plot work. They focus on entire agroecosystems, asking not about yield of individual crops but about the sustainable yield of entire systems. They do much of their work in farmers' fields rather than on experiment stations. Their clientele consist largely of farmers who want to reject the chemical model that has dominated American agriculture for the last 50 years.

In sum, to say that the "culture" of agronomy has changed is to recite a truism--but the change that has occurred has been largely the result of a massive restructuring of actor networks that goes far beyond the university. Whether the beliefs of agronomists have changed is a matter of

debate; in any case it is not self-evident. What is clear is that people, organizations, things, even nature have been reorganized and agronomists have been enrolled in new ways, building and using new black boxes, enrolling new clients. Those who have rejected these changes are now fewer in number, in part because many have embraced one of the newer networks and in part because many have left academia altogether.

Moreover, all the disciplines--as networks--*act at a distance*. Proponents of various brands of postmodernism send their students to other campuses as Assistant Professors to spread the new gospel. Electronic mail and the Internet extend networks to all places similarly equipped. Foreign students often return home with large quantities of intellectual baggage, defining problems, equipment, theories in the terms defined by their mentors. Indeed, students from less industrialized nations are often trained in such a manner that they are unable to engage in research without the laboratories, equipment, libraries and means for quick interaction with colleagues to which they have become accustomed during their studies in the US.

But Actor Network Theory suggests how a new division of knowledge might be produced as well as strategies for producing it, for it backs up and raises a new sort of question: How are the divisions themselves produced and reproduced? How do we determine where nature ends and culture begins? How do we determine where the developed world leaves off and the underdeveloped world begins? How do technical gadgets restructure society without being overtly political?

It also suggests that the only way to dissolve the barriers between the disciplines--to create the much vaunted interdisciplinary research that is rarely done--is to build counter networks! Rather than wallowing in the cultural differences that supposedly divide us, we need to think *and act* strategically to build new networks that cement new relations between the disciplines (Busch 1996). We need to build funding mechanisms that encourage cooperation across disciplinary lines. We need to challenge the nature/culture distinction (Rouse 1987). We need to break the monopoly on new knowledge currently held by the sciences by bringing nonscientists into the knowledge production process. Indeed, this has already happened in certain areas of medicine and agriculture.

To do this we need to think and act strategically in actor network terms. Consider the problem of disciplinary boundaries. Overcoming them might involve new forms of grants programs that require interdisciplinary collaboration, especially across the society/nature divide. It might involve the insertion of client groups right into the research process as proponents of participatory action research have suggested. Indeed, nothing is quite as effective in encouraging dialogue across disciplinary lines as clientele with pressing problems that require that dialogue. The National Science Foundation program on "Human Dimensions of Global Climate Change" is but a small step in that direction. But no single program for change can be developed because everything lies in the details. A counter network in one area--for example, so-called alternative medicine--might be organized quite differently than a counter network in another domain, such as participatory plant breeding.

Moreover, we need to create technology critics in the mold of art critics (Latour 1993a, Winner 1986), so as to reveal the politics behind the veil of scientific and technological determinism. This is not to say, of course, that the defenders of the old order will move quietly out of the way. Indeed, even suggesting this rather modest strategy has provoked an enormous reaction, popularized in the press under the term, "science wars." The very ferocious character of the response to science studies and ANT in some quarters suggests just how entrenched the existing networks are. Yet, only by constructing new networks can the old ones be realigned, restructured, and once again made relevant to the larger (moral) problems of society.

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